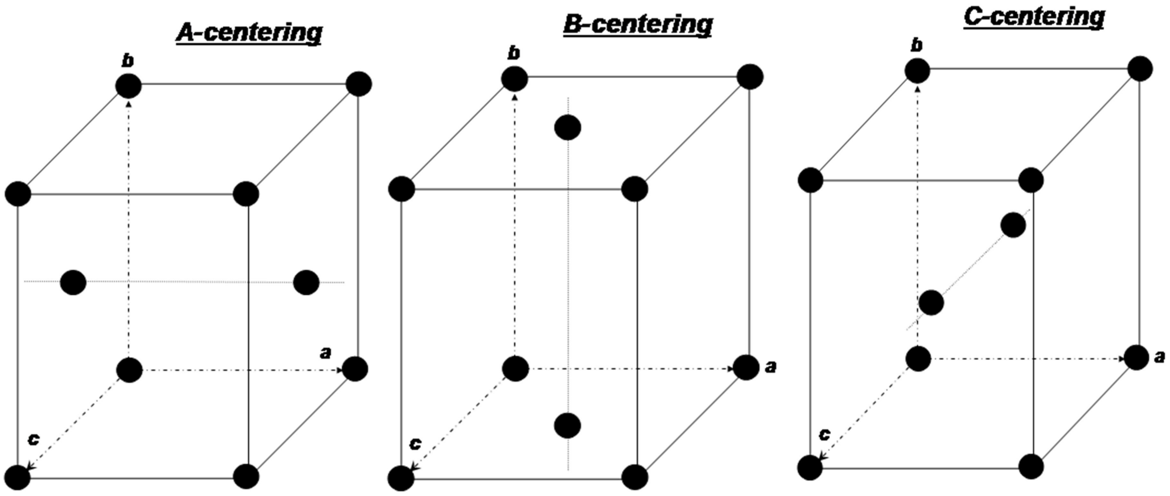
UNIVERSITÄT SIEGEN

FESTKÖRPERPHYSIK

7. Homework 3D crystal system, 3D Bravais lattice, reciprocal lattice

1. The monoclinic crystal system (see Figure below) has following relationships between the lattice constants and corresponding angles: $\boldsymbol{a} \neq \boldsymbol{b} \neq \boldsymbol{c}$ and = γ = α90°, $\beta \neq 90°$. In this lattice, a 2-fold symmetry axis is parallel and a mirror plane is perpendicular to the crystallographic b axis.

a) Why B-base-centered monoclinic lattice is not a special type of the Bravais lattice in contrast to the A- and C-base-centered Bravais lattices?



b) Why it doesn't make sense to define a base-centered cubic lattice as a special type of the Bravais lattice?

2.

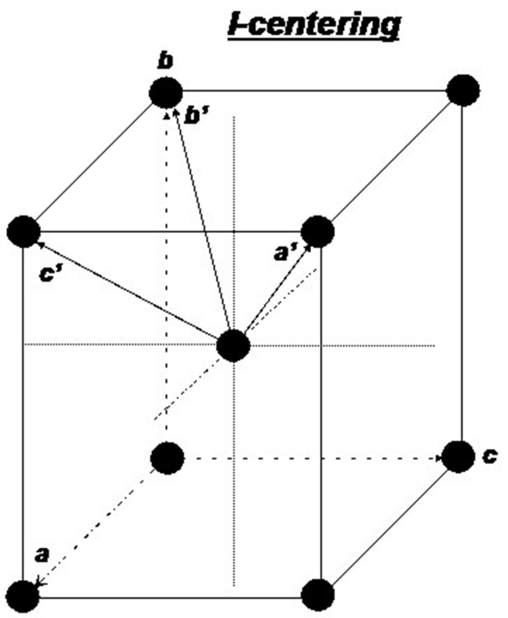
a) Prove that the two base-centered orthorhombic lattices, such as AB, BC or CA (A,B or C-base-centered shown in Figure above), are equivalent to an F-centered orthorhombic lattice.

b) Demonstrate that if [0,1/2,1/2] and [1/2,0,1/2] are the coordinates of the lattice points, then [1/2,1/2,0] is a coordinate of the lattice point as well.

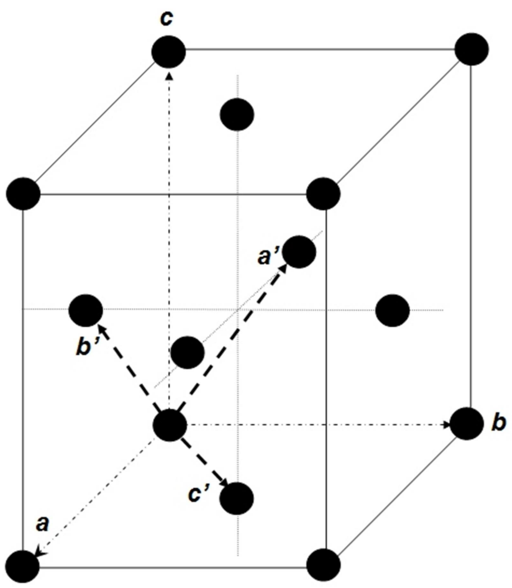
3. The body-centered cubic lattice is described by means of a non-primitive unit cell with the basis vectors **a**, **b**, **c** or by a primitive unit cell with a triple **a'**, **b'**, **c'** (see Figure below).

Find a ratio between the volumes of the non-primitive and primitive unit cells.

Define reciprocal lattice vectors **a***, **b***, **c*** for the body-centered cubic lattice.



4. The same task as for exercise 3 to be done for the face-centered cubic lattice (figure below)



Find a ratio between the volumes of the non-primitive and primitive unit cells.

Define reciprocal lattice vectors **a***, **b***, **c*** for the face-centered cubic lattice.